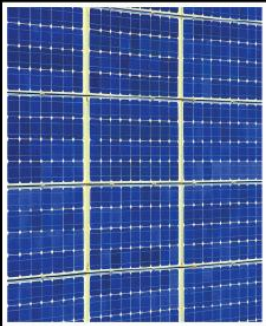


25TH RCI INTERNATIONAL CONVENTION AND TRADE SHOW



EXPLORING
the Sustainably
Built Environment

ROSEN SHINGLE CREEK RESORT
ORLANDO, FLORIDA

MARCH 25 - 30, 2010

THE DURABILITY PLANNING MATRIX:

A Useful Tool For Achieving Sustainable Building Envelopes

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New Green / Sustainable Building Standards

LEED®
(USGBC)

National Green Building Standard™
(ANSI/ICC 700-2008)

Green Globes
(ANSI/GBI 01-2005)

**Sustainability Assessment Standard
for Single Ply Roofing Membranes**
(ANSI/NSF 347-P)

**Standards for
Sustainable Roofing
Materials**
(ANSI/ULE)

**Standard for the Design of High
Performance, Green Buildings**
(ASHRAE 189.1-P)

**International Green Construction
Code**
(ICC)



The Challenge:

Integrating Durability Into Green Building Standards

“The majority of green building assessment systems focus on the design of the constructed building, with little focus on the effect of the building system’s life during operation. This tendency has resulted in a failure of many rating systems to properly consider durability, lifecycle cost, and the effects of premature building envelope failures.”

“Green Assessment Tools: The Integration of Building Envelope Durability. “ (McCay, 2008, p. 1)



Durability & Green Rating Systems

Too much focus on design, too little focus on operation...

... resulting in a failure to address:

- True life cycle cost
- Risk of premature failures



Two Approaches to Durability

- Performance-Based
- Process-Based



Two Approaches to Durability

Performance-Based

- Standardized criteria for acceptance or rejection
- Requires extensive research to validate
- More difficult to establish, but less difficult to use

Performance-Based Standard Example:

- NBS BSS 55 Preliminary Performance Criteria for Bituminous Membrane Roofing.

Process-Based

- Standardized framework for acceptance or rejection
- Requires practitioner experience to validate
- Less difficult to establish, but more difficult to use

Process-Based Standard Example:

- ISO 9001 Quality Management Systems: Requirements



Durability:

A Processed-Based Definition

“... the ability of a building or any of its components to perform its required functions in its service environment over a period of time without unforeseen cost for maintenance or repair.”

Canadian Standards Association “Guideline on Durability in Buildings”
(CSA S478-95, Rev. 2001)



Durability:

A Processed-Based Definition

The ability of a building or any of its components to:

- perform its required functions
- in its service environment
- over a period of time
- without unforeseen cost for maintenance or repair



Perform Required Functions

- Resist and re-direct moisture
- Resist air & vapor movement
- Resist thermal transfer
- Resist fire, wind, hail, and other loads
- Serve as a working platform for:
 - Rooftop equipment systems (HVAC, Telcom)
 - Rooftop energy systems (PV, Solar-Thermal)
 - Rooftop gardens and decks



Roof Durability Characteristics In Its Service Environment

- **Climatic Factors**
 - High wind / wind-blown debris zones
 - Severe hail zones
 - Cold climates / severe freeze-thaw zones
 - Warm climates / high uv zones
- **Operating Factors**
 - Frequency / density of use
 - Occupant capabilities / attitudes
 - Frequency / complexity of maintenance



Roof Durability Characteristics
Over a Period of Time

Period of Time =
Intended Service Life



Roof Durability Characteristics

Without Unforeseen Cost...



Implies Some Level of Cost
Should Be Foreseen!



Implies Planning Is
Necessary!



Roof Durability Characteristics

Without Unforeseen Cost for..

- **Maintenance**

- Frequent & ongoing
- Includes inspection, assessment, service, & minor repairs

- **Repair**

- Infrequent, but generally planned
- Includes renovation, retrofitting, component replacement



The Durability Planning Matrix

- **Emphasis on Process**
 - A management system
 - Similar to ISO 9000 & ISO 14000
- **Emphasis on Shared Responsibility**
 - Identifies stakeholders
 - Identifies roles

Durability and Canadian Standard S-478

Three Basic Steps:

1. Identify Durability Determinants
2. Identify Durability Interventions
3. Develop Action Plan & Timetable



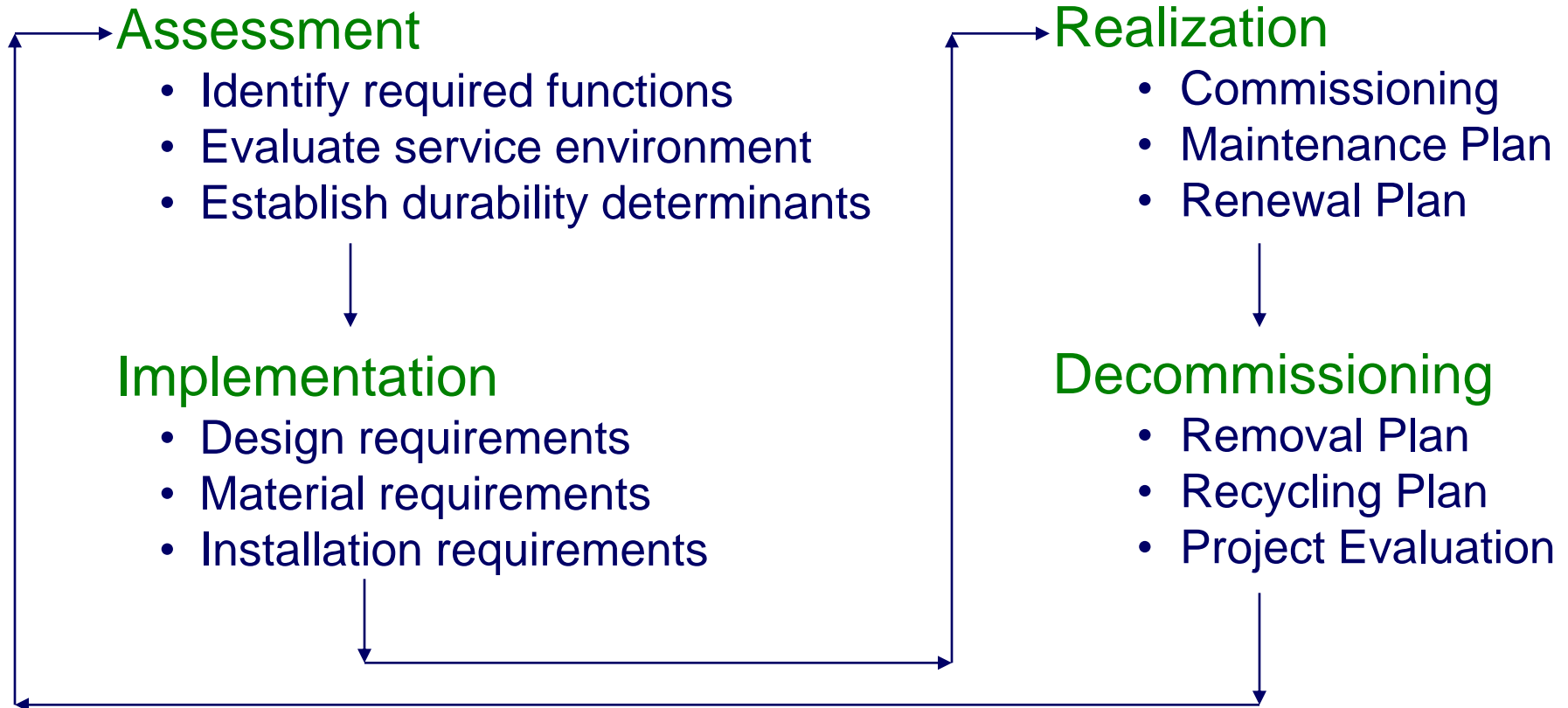
The Durability Planning Matrix

Four Dimensions:

1. Assessment
2. Implementation
3. Realization
4. Decommissioning



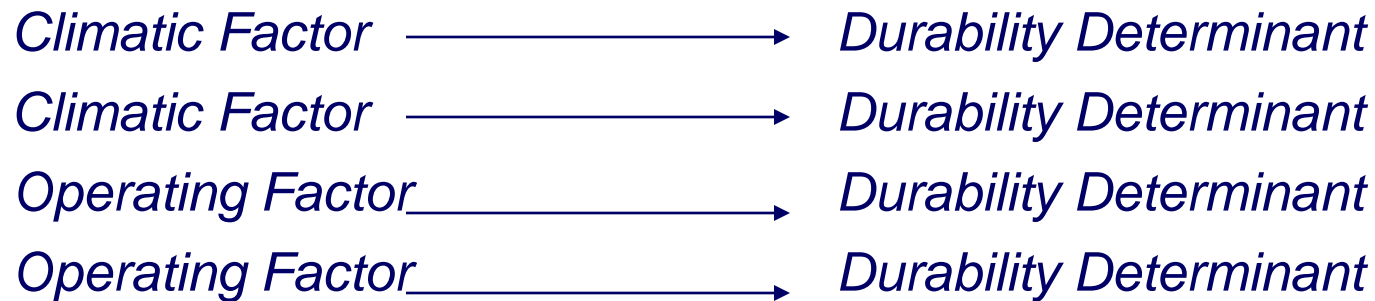
The Durability Planning Matrix



The Durability Planning Matrix

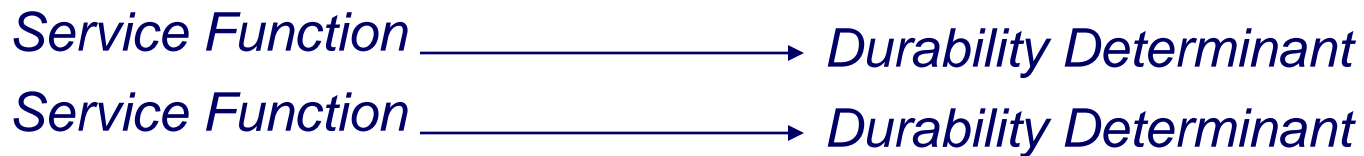
Assessment Phase

Service Environment:



Durability Determinants:

Required Functions:



The Durability Planning Matrix Assessment Phase

Example

Service Environment:

High Hail Zone



Durability Determinants:

Hail Resistance

Required Functions:

Equipment Platform



Traffic Resistance



The Durability Planning Matrix

Implementation Phase

Durability Determinants

Durability Determinant →
Durability Determinant →
Durability Determinant →
Durability Determinant →

Design Requirements

Design Requirement
Design Requirement
Design Requirement
Design Requirement

Installation Requirements

Installation Requirement ←
Installation Requirement ←
Installation Requirement ←
Installation Requirement ←

Material Requirements

Material Requirement ←
Material Requirement ←
Material Requirement ←
Material Requirement ←



The Durability Planning Matrix Implementation Phase

Example

Durability Determinants

Impact Resistance

Traffic Resistance

Design Requirements

No Through Fastening

Coverboard / Walkway

Installation Requirements

Coordinate Equip. Install

Material Requirements

Comp. Strength Std.

Tear Strength Std.

Hail Test Rating



The Durability Planning Matrix

Realization Phase

Durability Determinants

Durability Determinant →
Durability Determinant →
Durability Determinant →
Durability Determinant →

Commissioning

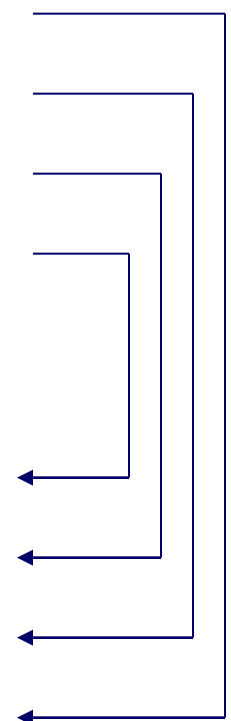
Comm. Procedure
Comm. Procedure
Comm. Procedure
Comm. Procedure

Renewal

← *Renewal Plan*
← *Renewal Plan*
← *Renewal Plan*
← *Renewal Plan*

Maintenance

← *Maintenance Procedure*
← *Maintenance Procedure*
← *Maintenance Procedure*
← *Maintenance Procedure*



The Durability Planning Matrix Realization Phase

Example

Durability Determinants

Impact Resistance

Traffic Resistance

Commissioning

Impact Load Test

Monitor Traffic

Renewal

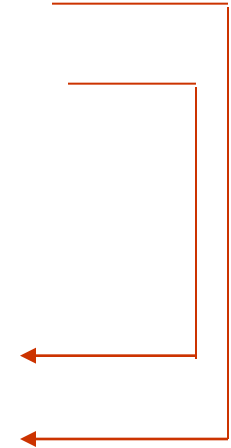
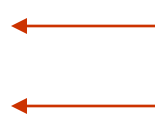
Replace Walkway Surface

*Adhere Redundant Layer
of Membrane*

Maintenance

Inspect Walkway

Inspect After Storm



The Durability Planning Matrix

Decommissioning Phase

Decommissioning Goals

Decommissioning Goal →
Decommissioning Goal →
Decommissioning Goal →
Decommissioning Goal →

Removal

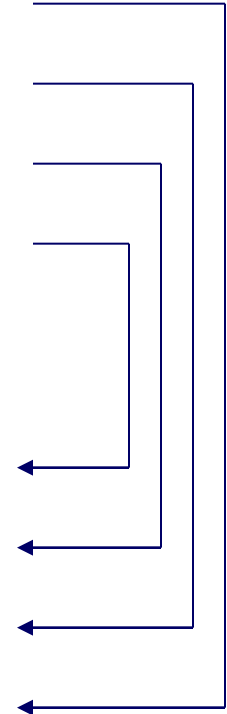
Removal Procedure
Removal Procedure
Removal Procedure
Removal Procedure

Evaluation

Improvement Plan ←
Improvement Plan ←
Improvement Plan ←
Improvement Plan ←

Recycling

Recycling Procedure
Recycling Procedure
Recycling Procedure
Recycling Procedure



The Durability Planning Matrix

Decommissioning Phase

Example

Decommissioning Goals

Minimize Environ. Impact

Minimize Environ. Impact

Minimize Environ. Impact

Removal

Disassembly Plan

Sorting, Storage Plan

Disposal Plan

Evaluation

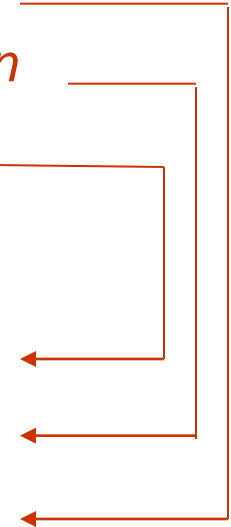
Improvement Plan

Recycling

Recycling Plan

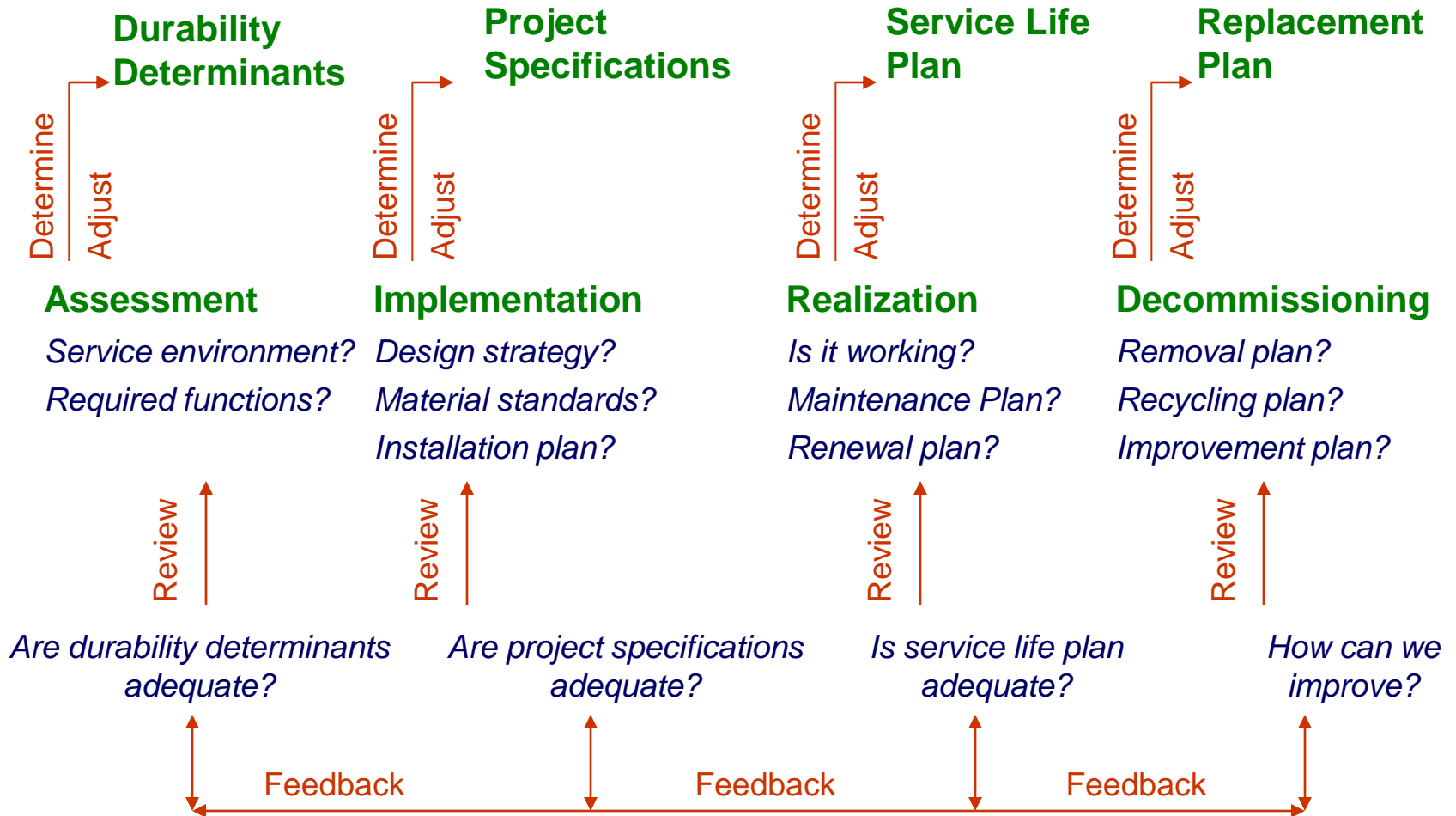
Recycling Plan

Recycling Plan



The Durability Planning Matrix

Overall Process Flow



The Durability Planning Matrix and the Roof Consultant

- Helps to organize and focus the design process
- Treats each roof as a unique challenge
- Allows for effective comparison of alternatives and evaluation of trade-offs
- Emphasizes the importance of the professional practitioner
- Builds teamwork and shared accountability with clients



The Durability Planning Matrix and the Roofing Industry

- Highlights the importance of professional practice as opposed to arbitrary standards
- May stimulate and focus industry research
- Provides the industry with a ready tool to address durability issues in green building standards



Next Steps

- Work with ASTM Roof System Durability Workgroup (WK26595) to incorporate a process-based approach into future standards
- Present further refinements of concept at the IC BEST Conference this June in Vancouver.
- Continue to refine the matrix worksheets
- Collaborate with interested practitioners to “test drive” the planning matrix

